PROGRAMME SPECIFICATION (Taught Postgraduate)	

1	**Awarding Institution**	Newcastle University
2	**Teaching Institution**	Newcastle University
3	**Final Award**	PGCert / PGDip / MSc
4	**Programme Title**	MSc Data Science (with Specialisation in Statistics)
5	**Programme Code**	MSc 4870F/P, PGDip 3527F/P, PGCert 3177F/P
6	**Programme Accreditation**	4870F/P - BCS, The Chartered Institute for IT
7	**QAA Subject Benchmark(s)**	Computing
8	**FHEQ Level**	Level 7
9	**Last updated**	Sept 2024

10 Programme Aims

1. To develop the multi-disciplinary skills essential to produce the trained experts in Data Science required by academia and industry.
2. To provide the fundamental computational knowledge and expertise required to tackle complex Data Science problems.
3. To provide an understanding of the most commonly used and important statistical methods, approaches and algorithms for the analysis of large and complex data sets.
4. To develop research skills
5. To develop and improve skills in the use of literacy resources and information technology
6. To encourage the development of creativity and problem-solving skills
7. To develop skills in critical assessment, analysis and storage of information and/or data
8. To provide a qualification enhancing employment prospects in Data Science
9. To provide a programme which meets the accreditation requirements of the appropriate professional bodies, thus providing a basis for further professional development and lifelong learning.
10. To provide a programme which meets the FHEQ at Masters level and takes appropriate account of subject benchmarks in QAA Computer Science at the Masters level and UK professional standards.

11 Learning Outcomes

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the following areas. The programme outcomes have references to the benchmark statements for Computing.

Knowledge and Understanding

On completing the programme students should be able to demonstrate:

A1. An understanding of the application of computational and statistical methods in Data Science.
A2. An understanding of data management, integration and handling.
A3. A demonstrable, broad knowledge of the computing, mathematical and statistical methods available for dealing with large and complex data analysis problems.
A4. Knowledge of current tools and technologies pertaining to Data Science.
A5. An understanding of the most commonly used statistical algorithms, their underlying assumptions, and limitations.
A6. Understanding of major professional, social, legal and ethical issues associated with Data Science.
A7. Advanced knowledge and understanding of chosen specialist areas in Data Science.

A8. An understanding of the principles and theory which underlie Data Science, so that students can appreciate the current state of these subjects and can adapt to continued rapid developments through their subsequent careers.
A9. An understanding of the principles of statistical modelling and inference so that students can tailor and adapt the ideas to address applied statistical problems through their subsequent academic study or careers.

Teaching and Learning Methods

Fundamental and specialist knowledge (A1-A9) are imparted largely through direct student contact (lectures and tutorials) and online blended delivery of content, supplemented by practical sessions that may take the form of computing sessions, problem solving and assessed coursework, and project work.

Student understanding and learning is enhanced by the use of computing and numerical exercises, problem solving, literature reviews, teamwork and practical work.

Independent learning is encouraged through the provision of reading lists, literature reviews and critical analysis of research papers, and ready access to online information sources. Adequate time is provided in all modules for private study for independent learning. The research thesis will enable students to devote extensive time to developing a deep understanding of a specialist area.

Assessment Strategy

A mix of formative and summative strategies are used to assess problem solving and programming skills, group work and research exercises. Additional formative feedback, provided both in-person and online, is included to provide student feedback throughout the course, without contributing to module marks. Formal feedback is provided for each piece of assessed coursework in the form of an individual proforma and a review session in subsequent lectures (A1-A9). Summative strategies, in the form of extended project work, are used to assess a student's learning achievements, for key modules.

Alongside module assessments, student learning throughout the programme is tracked through evidence of students' reflective practice. Students will develop reflective logs to articulate their personal development by mapping key learning outcomes embedded in assessed project work to a pedagogical framework for Data Science, and develop personalised action plans to further develop their competencies in identified areas. Individual meetings between the student and course team, will support students in developing their reflective practice and their preparation of reflective logs, and will act as a common thread of dialogue between students and the course team throughout the programme. The programme will conclude with a summative interview reflecting on students' learning across the programme as a whole, and implications for future career prospects or further study.

Intellectual Skills

On completing the programme students should be able to:

B1. Propose, carry out and write up an extended research project involving, where appropriate, a literature review, problem specifications, design, implementation, and analysis.
B2. Design and implement new software packages, and compositions of existing packages.
B3. Apply their knowledge of specific computational, mathematical and statistical techniques to the storage and analysis of data.
B4. Have expertise in the use and applicability of up-to-date programming languages and software tools.
B5. Construct and analyse appropriate statistical models using data and other information sources.

Teaching and Learning Methods

Intellectual skills (B1-B5) are imparted by a combination of lectures, practicals, case studies, a group project, and an in-depth research project tailored to individual interests. Modules are delivered in the form of 'short fat' modules that augment formally taught material with more directed self-learning including the use of interactive tutorials (both tutor and student led), self-directed study, laboratory practicals, problem-based learning and investigative work. The use of short fat modules has several advantages: (i) key skills

development and deep learning is enhanced due to increased student participation and interest; (ii) learning is concentrated, allowing the student to focus in depth on one subject at a time; (iii) modules have the potential to be made available as short courses aimed at continuing professional development (for industry or academia); and (iv) enables future extension of module choices. Practical sessions and problem-solving exercises are used to develop programming and analytical skills (B2-B3). Tutorials are used to focus on specific research topics in detail, to carry out problem solving exercises (B1) and critical analysis of the current software libraries (B4), analytical techniques (B3) and research literature, to ensure up-to-date knowledge of subject-specific research fields.

Assessment Strategy

Intellectual skills (B1-B5) are continuously-assessed through written reports, practical write-ups, literature reviews, group projects, oral presentations, a poster presentation and a research thesis. The assessment methods aim to evaluate the students' understanding and ability to apply the computational and statistical techniques that form the basis for the interdisciplinary field of Data Science.

Practical Skills

On completing the programme students should be able to:

C1 Critically evaluate research and literature relating to computational and statistical aspects of Data Science.
C2 Solve computational problems at scale using appropriate scalable and data-parallel architectures.
C3 Present, store and query data.
C4 Demonstrate appropriate scalable computational workflows and solutions applied to large information handling problems.
C5. Apply methods to characterise and manipulate data sets for modelling and classification.
C6. Apply appropriate statistical software to analyse data sets and interpret the results.

Teaching and Learning Methods

Critical evaluation of current research will be developed through literature searching, through coursework exercises and in the research project in particular (C1). The ability to solve computational and statistical problems at scale (C2) will be acquired through practical sessions and self-directed learning. Tutorials and group discussion will be used to reinforce specific computational and statistical methodology (C4-C5). Problem solving exercises and the group project will be used to improve student skills in the application of appropriate statistical methods to big data handling and analysis (C3-C6).

Assessment Strategy

Practical skills (C1-C6) are primarily assessed continuously in the form of individual reports from practical studies, literature reviews, tutorial exercises, group project reports and the project dissertation. Data and information handling and interpretation are a strong component of many modules and are also assessed through continuously assessed problem solving exercises.

Transferable/Key Skills

On completing the programme students should have:

D1. The ability to communicate orally
D2. Written communication skills
D3. The ability to use computer based literacy resources
D4. The ability to work as part of a team
D5. Creativity skills

Teaching and Learning Methods

Oral presentation skills are exercised by group discussions in tutorial sessions, by communication during group exercises, and by the preparation of oral presentations on specific research topics (D1). Written communication skills are developed during independent study, the preparation of coursework, poster presentation and through the completion of the group project and the project thesis (D2). Formal lectures and practicals address the use of online literacy resources and research techniques, reinforced through

the use of practice exercises (D3). Group project, industry led projects, and student-led tutorials are used to develop team skills (D4). Creativity skills are developed through data visualisation, problem-solving and user driven development in project work (D5).

Assessment Strategy

Written communication skills are assessed by report preparation, the research thesis and literature reviews. Oral communication skills are assessed in oral presentations. The ability to use computer-based literacy resources is assessed through the preparation of literature reviews and through peer- and self-assessment. Team work is formally evaluated using group-based problem solving and data analysis exercises. Independent work is assessed in literature reviews and research projects. Creativity is assessed through problem-solving exercises and poster preparation.

12 Programme Curriculum, Structure and Features

Basic structure of the programme

The programme is studied over one year full-time, or two years part-time. All modules are compulsory. The programme consists of two parts: a ***taught component*** that runs for 6 months and a ***research project*** of 6 months duration, for which a thesis is submitted. The programme is centred in the School of Computing, where the students will be based. Due to the interdisciplinary nature of the course, several modules are delivered by members of the School of Mathematics, Statistics and Physics.

The programme consists of mandatory modules, and the major individual project and dissertation. The programme provides comprehensive training in interdisciplinary aspects of Computing Science and Statistics. The taught component of the course accounts for 100 credits and the Research Project 80 credits.

The ***taught component*** of the course is split across Semester 1 and Semester 2.

Semester 1 modules build the basic grounding in, and understanding of, Data Science theory and applications. Six mandatory modules (60 credits) run from Week 1 to Week 12. Modules centred around the School of Computing. A further module share teaching and practical activities with an existing MSc module, but features individual extended project assessments; and modules covering statistical content, contextualised within Data Science and industry application areas. These modules are assessed through coursework, extended project work and individual interviews, continuously throughout Semester 1.

Semester 2 introduces modules that build key research skills and commercial acumen (generic and specialist) and impart deep learning by building on, and applying, the fundamental knowledge gained in Semester 1.

In addition, there will be a Group Project module where students will work in small groups to solve a practical applied problem in Data Science. This will provide opportunity for mutual peer-to-peer mentoring in complementary areas of expertise, and help form cross-disciplinary relationships that can persist through the period of study. Where possible, the projects will be appropriately constrained but genuine research problems provided by our industrial or applied academic collaborators.

Semester 3. Students will undertake a research project of six months duration. The research project may be based in a research group within the University, or in collaboration with a sponsoring industry organisation or employer. The course will adopt a co-supervision model for each student, comprising a lead supervisor from Computing Science or Mathematics and Statistics, and an additional supervisor from another academic or an industrial collaborator from the project domain that inspired the project.

Key features of the programme (including what makes the programme distinctive)

The MSc in Data Science will deliver trained postgraduate students who have advanced knowledge, understanding and skills that will equip them for a career in Data Science or industry more broadly. Particular features of the programme are:

Industry engagement: Engagement with industry partners from a range of sectors (e.g. automotive, manufacturing) will support students to develop discipline-specific knowledge, with aspects of the course tailored to participants' interests. Secured industry commitment supports us to ensure meaningful industry engagement for each member of the student cohort.

Flexible participation: We are committed to creating pathways of interaction, for non-standard University applicants from industry. To this end, we are exploring the use of blended learning approaches to facilitate participation from a broader range of candidates. Novel assessment methods centred around extended project work and reflective interviews, offer an alternative to written examinations which are more amenable to industry participation, and support students to develop a rich portfolio of experience in the area of Data Science.

Tailoring provision for sectoral (and organisational) variations: The sectoral and organisational variations in the application of Data Science is widely acknowledged. Our teaching provision will be designed to be scalable, while accommodating tool preferences of participants, their employers and the broader sector. Taught concepts will be situated in context, drawing on application areas relevant to participants. We will use a selection of sample datasets obtained from our industry partners, to tailor practical exercises to particular domains.

Project Work: We provide every student with the opportunity to undertake a project with industry, working alongside organisations, collaborating with the National Innovation Centre for Data (NICD) and programme sponsors. We also support work-based dissertation projects, tailored for industry professionals. Participants will document a work-based project to apply their data analytics skills obtained during the course, for real problems faced by their employer. This will be underpinned by a portfolio of evidence, with supporting reflective accounts.

Programme regulations (link to on-line version)

-R4870+Data_Sci_Stats.pdf (ncl.ac.uk)

13 Support for Student Learning

Generic information regarding University provision is available at the following link.

Generic Information

14 Methods for evaluating and improving the quality and standards of teaching and learning

Generic information regarding University provision is available at the following link.

Generic Information

Accreditation reports
4870F/P - BCS, The Chartered Institute for IT

Additional mechanisms
An Industry Advisory Board has been established to provide input into curriculum development and provide expert advice on sector-specific applications of Data Science. A Curriculum Development Group will comprise academic experts in Data Science, students, and select industry partners. The Curriculum Development Group will incorporate advice from the Industry Advisory Board and develop curriculum in light of stakeholder feedback, including student course evaluation.

Turnitin is routinely used by the School to detect plagiarism where appropriate.

15 Regulation of assessment
Generic information regarding University provision is available at the following link. Generic Information

In addition, information relating to the programme is provided in:
The University Prospectus: http://www.ncl.ac.uk/postgraduate/ Degree Programme and University Regulations: http://www.ncl.ac.uk/regulations/docs/

Please note. This specification provides a concise summary of the main features of the programme and of the learning outcomes that a typical student might reasonably be expected to achieve if she/he takes full advantage of the learning opportunities provided.